

WORLDSKILLS STANDARD SPECIFICATION

Skill 16
Electronics





THE WORLDSKILLS STANDARDS SPECIFICATION (WSSS)

GENERAL NOTES ON THE WSSS

The WSSS specifies the knowledge, understanding and specific skills that underpin international best practice in technical and vocational performance. It should reflect a shared global understanding of what the associated work role(s) or occupation(s) represent for industry and business (www.worldskills.org/WSSS).

The skill competition is intended to reflect international best practice as described by the WSSS, and to the extent that it is able to. The Standards Specification is therefore a guide to the required training and preparation for the skill competition.

In the skill competition the assessment of knowledge and understanding will take place through the assessment of performance. There will not be separate tests of knowledge and understanding.

The Standards Specification is divided into distinct sections with headings and reference numbers added.

Each section is assigned a percentage of the total marks to indicate its relative importance within the Standards Specification. The sum of all the percentage marks is 100.

The Marking Scheme and Test Project will assess only those skills that are set out in the Standards Specification. They will reflect the Standards Specification as comprehensively as possible within the constraints of the skill competition.

The Marking Scheme and Test Project will follow the allocation of marks within the Standards Specification to the extent practically possible. A variation of five percent is allowed, provided that this does not distort the weightings assigned by the Standards Specification.



WORLDSKILLS STANDARDS SPECIFICATION

SECTION		RELATIVE IMPORTANCE (%)
1	Work organization and management	15
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none">• The importance of:<ul style="list-style-type: none">• Creativity• Critical thinking• Honesty and integrity• Self-motivation• Problem-solving• Effective working under pressure• Health and safety legislation and best practice in relation to the skill• Various electronics specialisms within specific industries• Different international languages and symbols and the interpretation of expressions between English and international languages, electronic symbols and units of measurement• The importance of continuous personal development• Business environment of the client• The company culture and procedures and potential variations dependent on national practice• The application of electronic principles	



	<p>The individual shall be able to:</p> <ul style="list-style-type: none">• Conduct the work in an environmentally professional manner, respecting others' work space• Work effectively with colleagues and teams both in the local environment and remotely• Present ideas to teams and clients• Exercise appropriate care in the workplace for personal and other's safety• Take appropriate preventative action to minimize accidents and their impact• Use materials and tools of the electronics industry in ordinary servicing, installation and repair tasks (hand tools, different soldering and de-soldering tools)• Use computers as a tool to effectively complete tasks for example;<ul style="list-style-type: none">• Creating networks• Interconnection between computers and other devices• Keep up to date with changes in technology• Proactively engage in continuous professional development• Develop a culture of effective record keeping to facilitate traceability for future development and maintenance and to comply with international standards• Read blueprints, wiring diagrams, schematic drawings, technical manuals and engineering instructions• Interpret and recognize international symbols, diagrams and languages used by other International Standards Institutes (e.g. DIN, BS, ISO, MIL,UL)• Source and purchase components and test equipment to meet specifications and be cost effective• Write reports and record data about testing techniques, laboratory equipment and specifications to assist engineers• Install equipment, a component, a unit, an upgrade or refurbishment into plant etc.• Communicate effectively with the customer• Train on the use of the installation• Act professionally on clients' premises• Initiate records for on-going maintenance policy• Establish maintenance contract where appropriate• Use computers as a tool to design test strategies, programme test routines and collect test data	
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2	Application of Electronics Principles in Practice	10
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • Electronic Circuit Component Specifications <ul style="list-style-type: none"> • Analogue and digital logic circuit and sensor circuit • AC and DC technology • Power • Wire and cables • Connectors • Displays • Circuit Design <ul style="list-style-type: none"> • Analysis, of electrical circuits, electronic circuits, digital logic circuit and sensor circuit • Basics of AC and DC technology • Two part LRC network, resistive networks with up to three meshes • RC oscillators • Multistage and special amplifier circuits <ul style="list-style-type: none"> • Basic amplifier circuits (AC, DC and power amplifiers) • Differential amplifiers/operational amplifiers • Ideal operational amplifier: (infinite input resistance, zero output resistance and infinite open loop gain) • Basic circuits with operational amplifier, analogue adder and subtractor, differentiator, comparator, impedance transducer • Real operational amplifier: offset voltage and offset current, compensation, common mode gain and rejection, temperature drift, frequency response • Generators and pulse shapers <ul style="list-style-type: none"> • Generators for sine wave voltage: RC, quartz, LC oscillators, Wien bridge generator, phase generator • Pulse shaper: Schmitt trigger, differentiator and integrator • Digital electronics <ul style="list-style-type: none"> • Level switching function, function table, pulse, diagram, circuit symbols • Properties of basic gates AND, OR, NOT, NAND, NOR, EXCLUSIVE OR EXCLUSIVE NOR • Substituting basic NAND or NOR gates for basic gates • Creating switching functions from given circuits and vice versa • Simplifying switching networks using Karnaugh diagram or mathematical techniques • Flip-flops, RS flip-flop, D flip-flop, JK Master slave flip-flop (especially counter circuits, shift register and frequency divider) 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Identify and analyse the appropriate principle for the task • Apply cognitive skills as appropriate to the task 	



3	Hardware Design	20
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • The application of electronic principles • Specialist (PCB design) software • Design fit for purpose • Process of converting a design into actuality 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Design small modifications to electronic basic electronics blocks • Discuss professionally and interpret a briefs and specifications • Draw a developed schematic circuit using E-CAD programme • Design a Printed Circuit Board layout using E-CAD programme • Design a 3D Printed Circuit Board layout using E-CAD programme • Communicate design and data using appropriate files and format to the manufacturer ensuring accuracy for manufacturing equipment and processes • Assemble components and Printed Circuit Board to IPC-A-610 issue E standard • Test the prototype • Use computer simulation as part of the design and testing process • Conduct circuit simulation using SPICE software 	
4	Embedded Systems Programming	20
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • Circuit boards, processors, PIC chips, electronic equipment and computer hardware and software • Programming of embedded systems by using C-language and Integrated Development Environments (ex MPLAB) • The application of electronic principles 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Programme embedded systems by using C-language and Integrated Development Environments (ex MPLAB) • Set up hardware and software applications • Compile a 'C' programme loaded into a PIC controller for test purposes • Locate, correct and re-compile syntax errors • Modify 'C' programmes such that the demonstration board performs different activities • Calculate and demonstrate an understanding of C expressions and loop codes 	
5	Fault Finding, Testing, Repair and Measuring	15
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • The application of electronic principles • Contexts in which the function of fault finding, testing, repair and measurement takes place • The limitations and applications of test equipment • Implications of unreliable equipment on a business and preventative maintenance 	



	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Take measures on electronic circuits (with DVM, scope, data collection equipment etc.) • Determine causes of operating errors and the required action • Adjust and replace defective or improperly functioning circuitry and electronics components, using hand tools and soldering iron • Test electronics units, using standard test equipment, and analyse results to evaluate performance and determine need for adjustment • Locate, test and replace faulty electronic components in a printed circuit board, surface mounted board or mixed technology • Use conventional measuring and testing equipment to test, set, adjust and measure electronic components, modules and equipment that are based in DC, AC, digital and analogue electronics. • Record and analyse measured results and data • Collect and analyse the evidence both manually and remotely • Use specialist equipment effectively to measure, diagnose and repair faults • Communicate effectively, especially with non-technical people • Support the development of preventative maintenance schedules • Perform preventative maintenance and calibration of equipment and systems • Use automatic test equipment • Effectively use digital documentation of measuring results • Measure specific electrical parameters with precision or plotting variations over time to ascertain circuit • Test device operations by validating input, output and processing 	
6	Assembly	20
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • Different international quality standards • The importance of keeping up to date about changing standards and technologies • Implications of International Standard for Quality of Design IPC-A-610 issue E • The application of electronic principles • The various components used 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Assemble and utilize mechanical parts such as DC Motor, AC Motor, Stepper motor Solenoid, sensors etc. • Connect assemble mechanical parts to form a working unit • Wire and form cables • Assemble and use various types of parts and surface mounted devise parts • Assemble parts to standard determined by IPC-A-610 • Work to correct sequences and tolerances • Accurately solder components using lead free solder to comply with industry standards 	